

# Status of GERB products

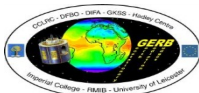
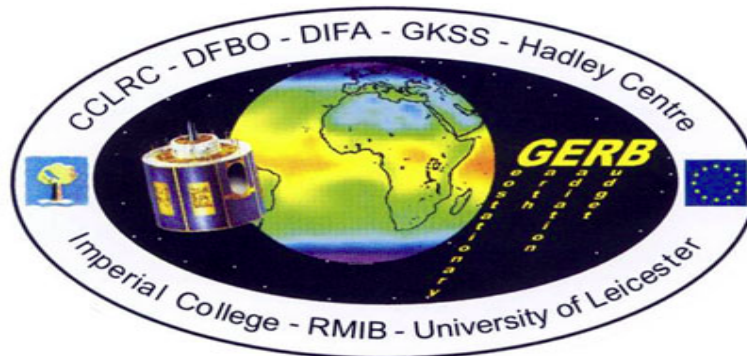
RMI

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2019 CERES team meeting, 7 – 9 May

email: [gerb@oma.be](mailto:gerb@oma.be)

web pages : <http://gerb.oma.be>

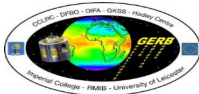


# GERB data taking history

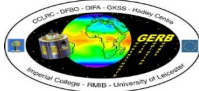
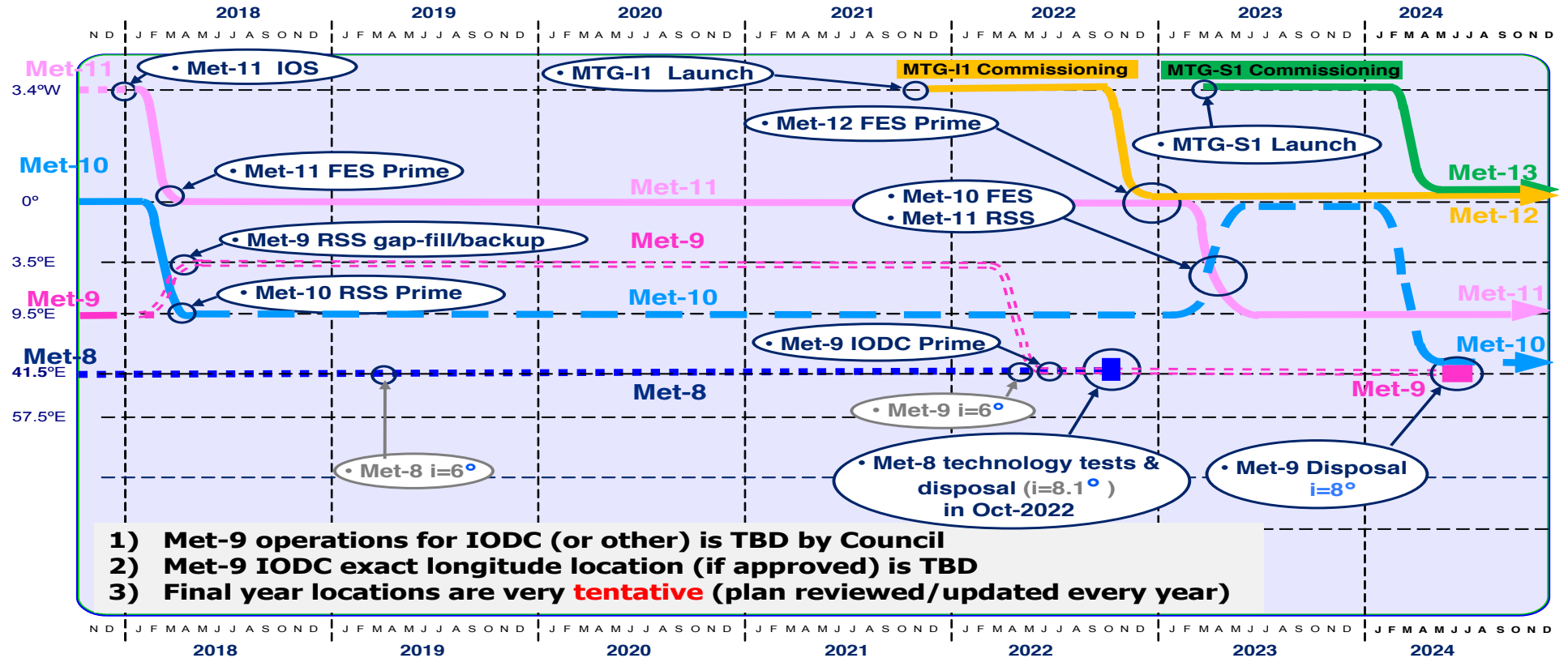
- Longitude 0°
  - GERB-2 (Met-8): April 2004 – May 2007
  - GERB-1 (Met-9): May 2007 – Jan 2013
  - GERB-3 (Met-10): Jan 2013 – Feb 2018
  - GERB-4 (Met-11): Feb 2018 – expected 2022/2023
  - GERB-3: 2022/2023? - ...

## Move Met-8 (GERB-2) to Indian Ocean Jul 2016 – Sep 2016

- Longitude 41.5° E
  - GERB-2: Oct 2016 – expected 2022

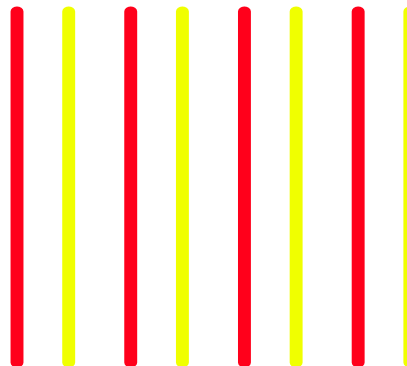


# Meteosat planning

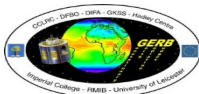


# GERB instrument

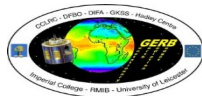
- 256 sensors recording a vertical slice (north – south) of the earth
- Two-sided rotating mirror
  - Counteract spinning of the satellite
  - 1 vertical line recorded per satellite revolution
  - Sequential scan of the earth line by line
- 2 channels: SW (quartz window) and TW



**Front mirror**  
**Back mirror**

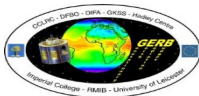


# GERB problems



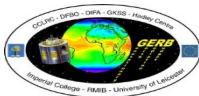
# GERB problems

- GERB-4
  - Mirror planes not completely parallel -> Front and back mirror columns shifted by  $\sim 1/2$  pixel vertically
  - Recorded signal brighter compared to other GERB instruments
- GERB-3
  - Rotating mirror blocked April 2013, restored Feb 2015
  - Increased aging of the mirror face exposed to the sun
  - Average difference  $\sim 3\%$
  - Mirror face response difference wavelength dependent (larger at shorter wavelengths)



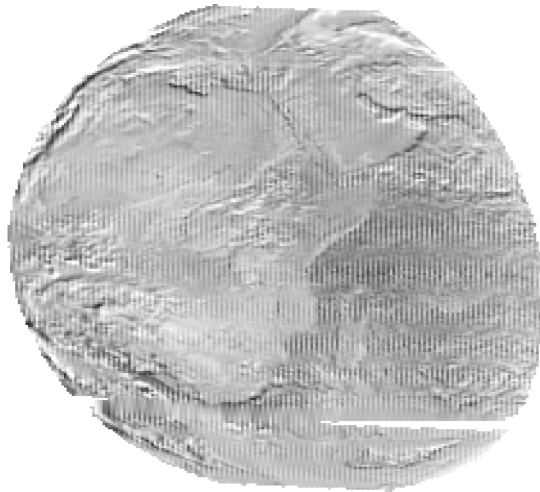
# GERB problems

- GERB-2
  - Some pixels are dead -> masked out
  - Hibernated from May 2007 – September 2016
    - Non-optimal parking position rotating mirror -> different aging of the mirror faces
    - Average difference ~10%
    - Mirror face response difference is wavelength dependent (larger at shorter wavelengths)
  - Column recording dependent on TSOL signal
    - Use Sun Sensor Unit (SSU) from mid August -> mid February
    - Use Earth SU (ESU) from mid February -> mid August due to SSU obstruction
    - Noise on ESU TSOL (Time Start Of Line) signal -> bad pointing of columns

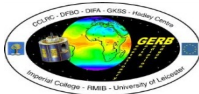


# GERB-2 aging problems(1)

- Asymmetric aging of the de-spin mirror faces, wavelength dependent (present in SW and not in LW )

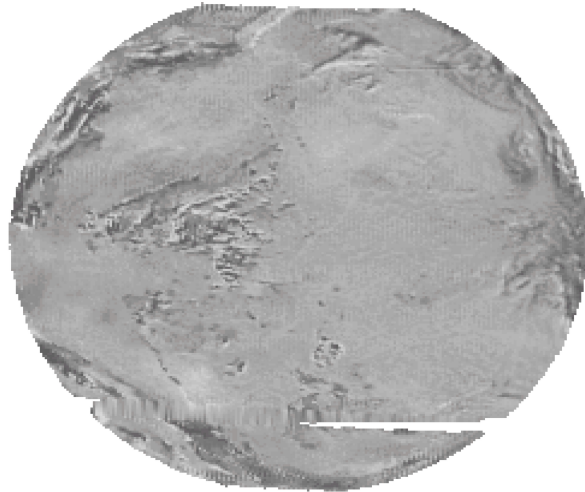


Comparison of SW with GERB SW emulation using SEVIRI data

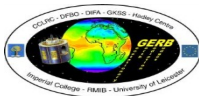




## GERB-2 aging problems(2)



Comparison of LW with GERB LW emulation using SEVIRI data



## GERB-2 aging problems(3)

- Noise on the Earth Sensor Unit (ESU) timing (TSOL jitter)

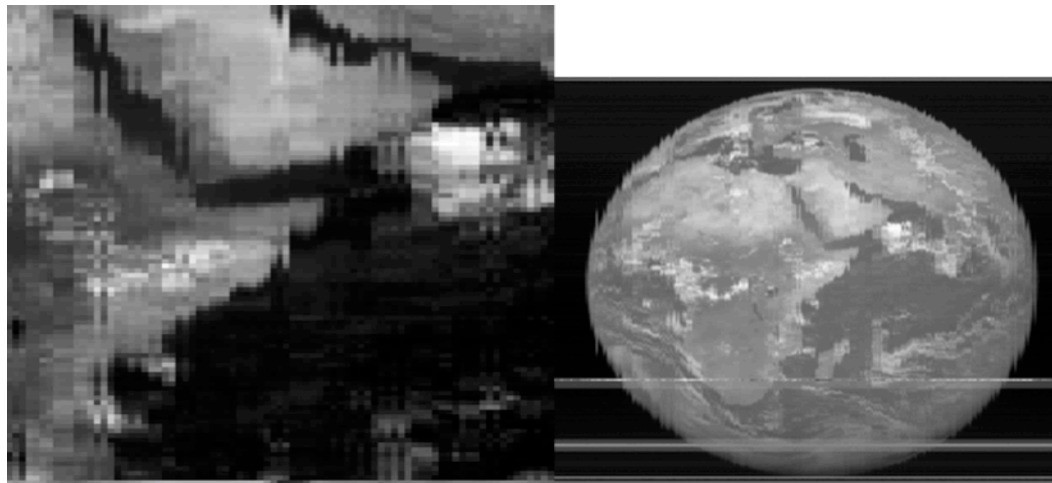
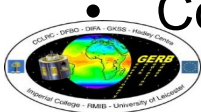
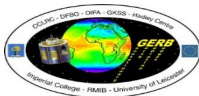


Image: J. Rufus (ICL)



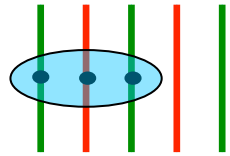
- Columns are acquired at the wrong position

# Problem handling



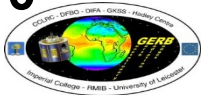
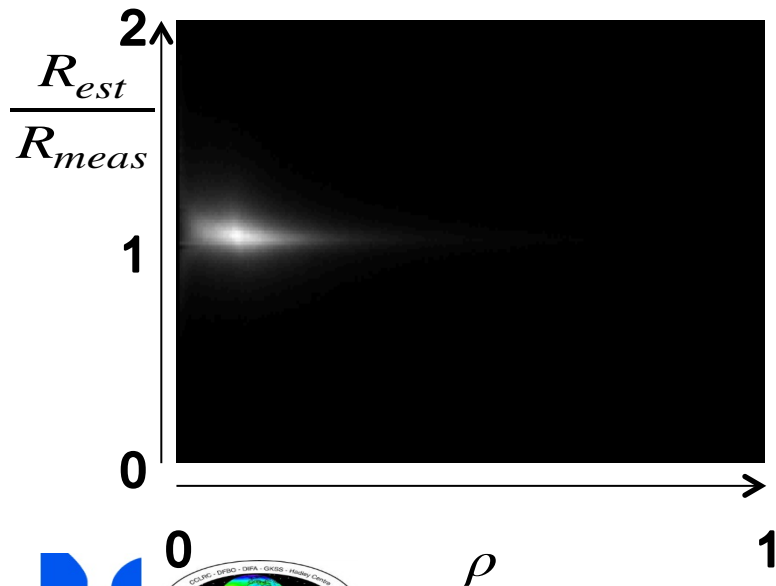
# Correcting mirror face difference

- Determine correction factor in function of reflectivity:

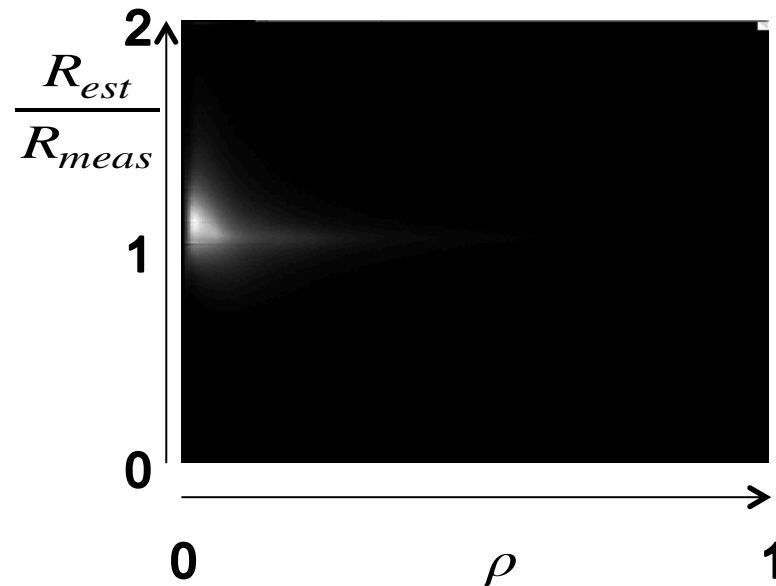


$$\rho_{SW} = \frac{L_{SW} d^2}{L_{sun} \cos \theta_{ZA}}$$

$$R_{est}(k) = \frac{R_{meas}(k-1) + R_{meas}(k+1)}{2}$$



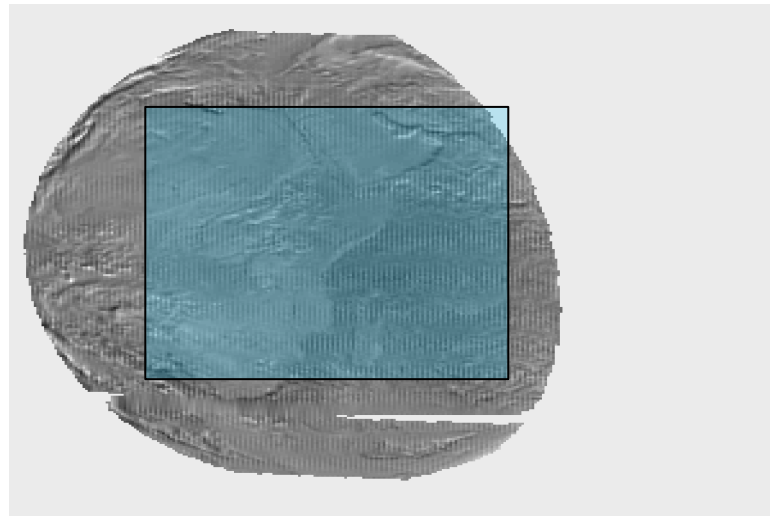
$\rho$   
Land scenes



$\rho$   
Ocean

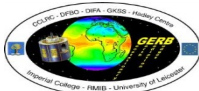
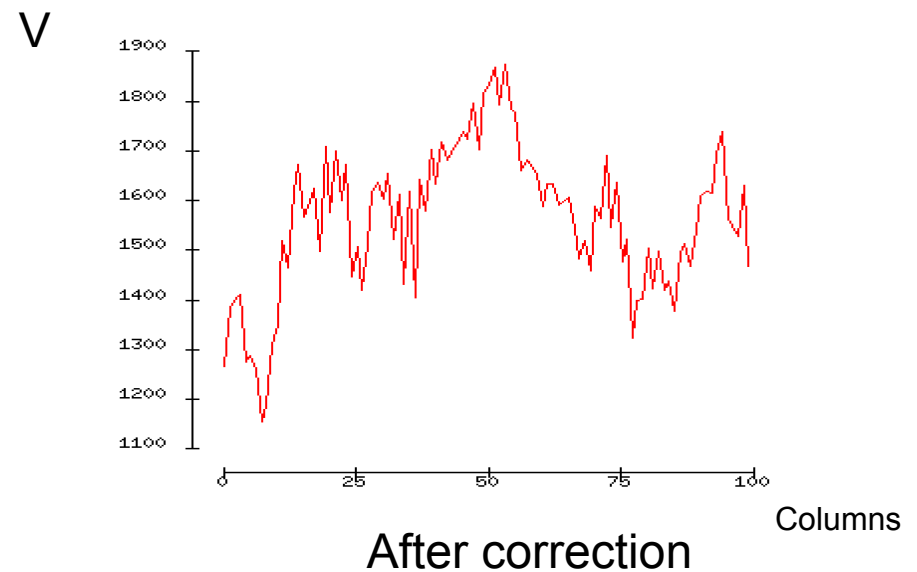
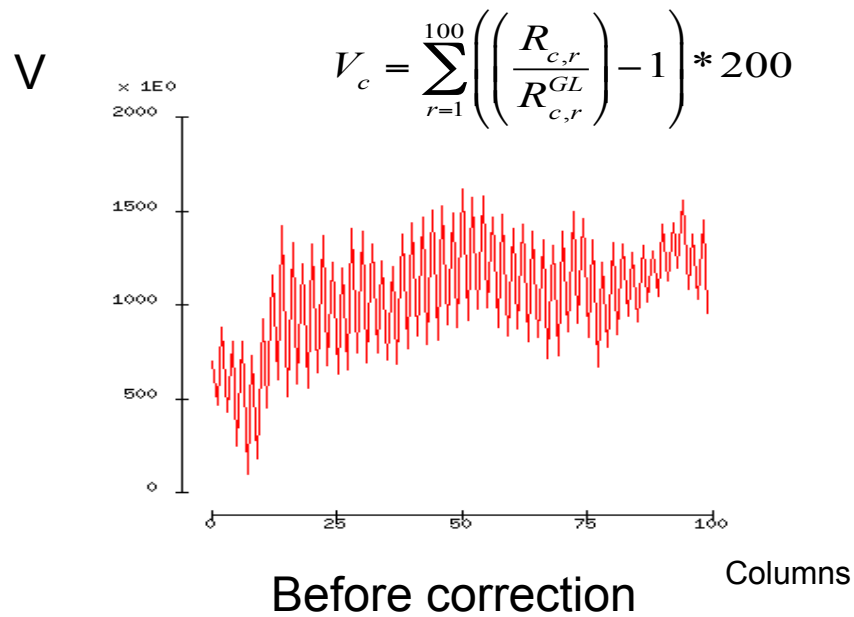
# Correcting mirror face difference

- Comparison between GERB and GERB-like (SEVIRI)
- Sum correction factors of 100 vertical pixels (central region) for each column

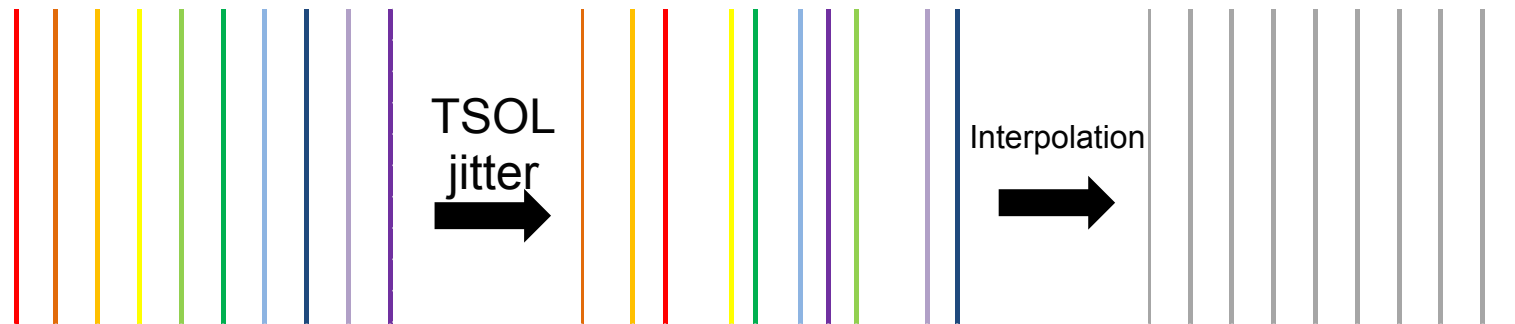


# Correcting mirror face difference

Comparison between GERB and GERB-like (SEVIRI)



# Correcting TSOL jitter



Sequentially acquired  
columns

Random acquisition

No acquisition time

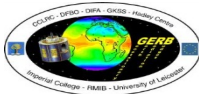
Evenly spaced

Repositioned

Regularly gridded

Inaccurate pointing

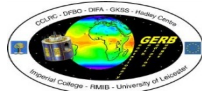
Accurate location



by J. Rufus

# Correcting TSOL jitter

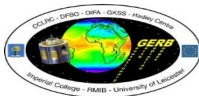
- Images recorded with 282 or with 564 (avoid mirror face problem) columns
- 282 column images (regular GERB image, 2 m 50 s acquisition time )
  1. Determine actual column position using the TSOL jitter data
  2. Reorder columns according to actual position
  3. Split image in 141 columns taken by the front mirror face and 141 columns taken by the back mirror face
  4. Interpolate to integral column positions for each half image
  5. Merge half images to get a full 282 image
  6. Do mirror face correction



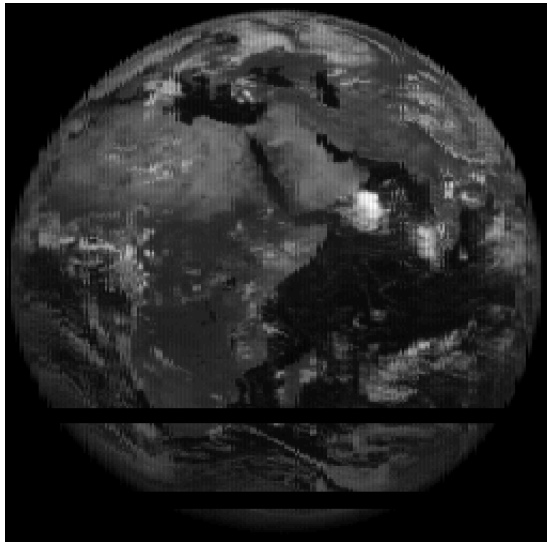


# Correcting TSOL jitter

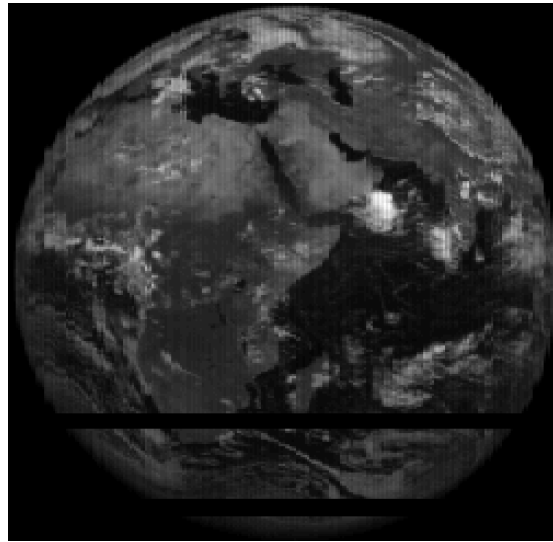
- 564 column images (double scan, 5 m 40 s acquisition time)
  1. Determine actual column position using the TSOL jitter data
  2. Reorder columns according to actual position
  3. Drop columns taken by the back mirror face
  4. Interpolate to integral column positions



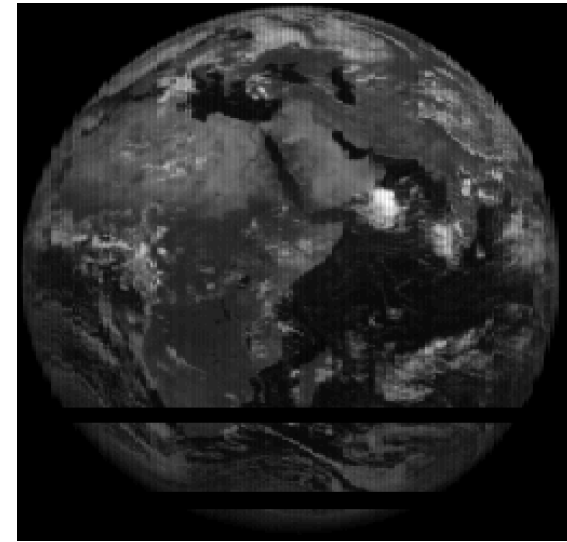
## Correcting 282 column SW TSOL jitter



Input image

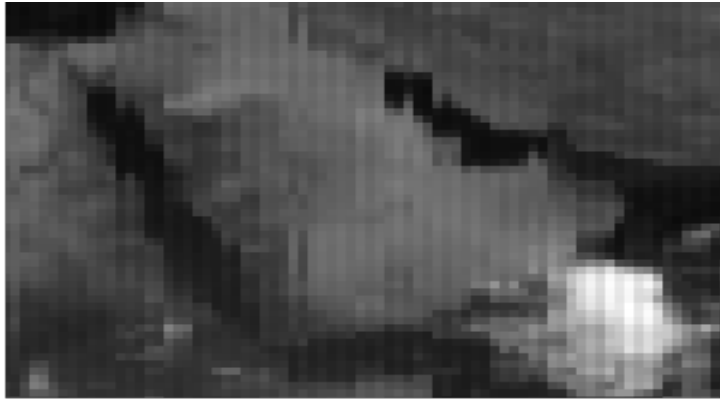


After reordering columns

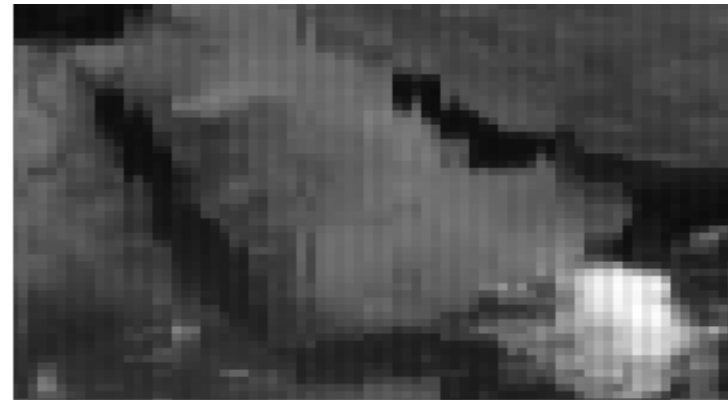


After interpolation and merging

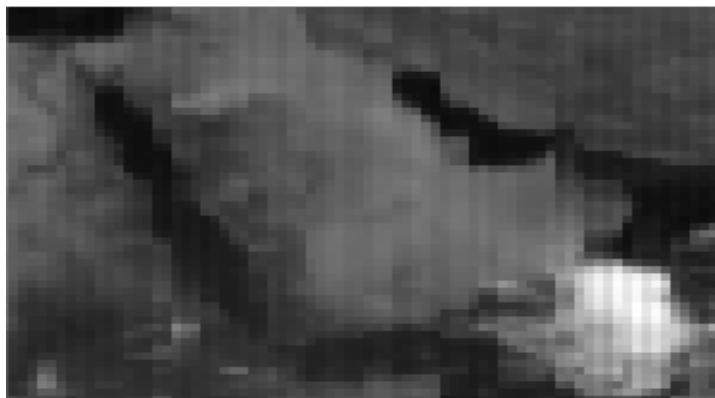
## Correcting 282 column SW TSOL jitter



Input image

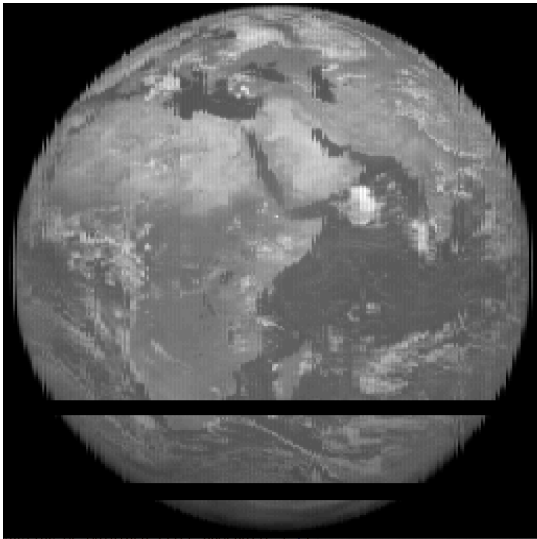


After reordering columns

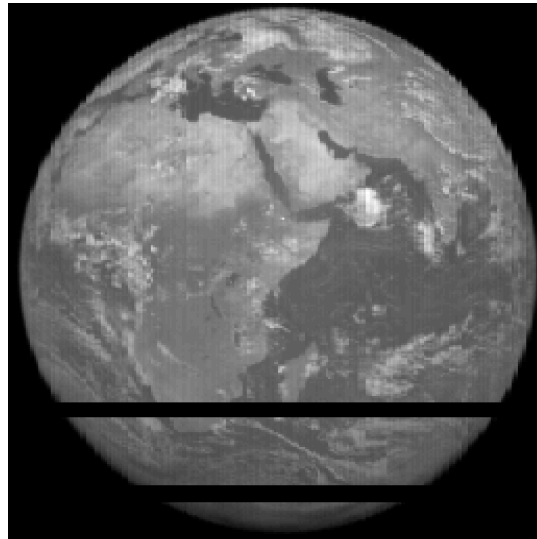


After interpolation and merging

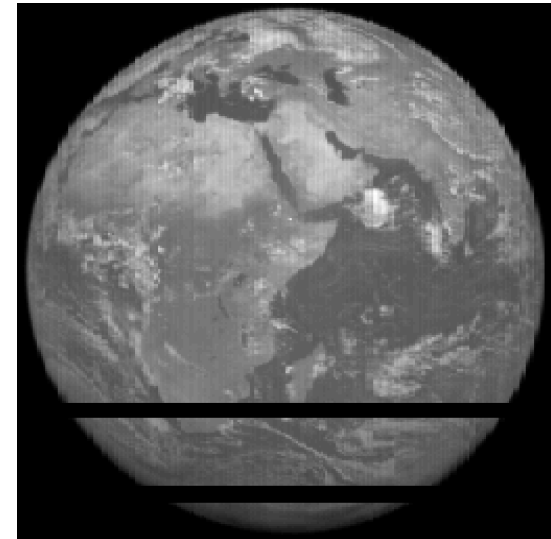
## Correcting 282 column TW TSOL jitter



Input image

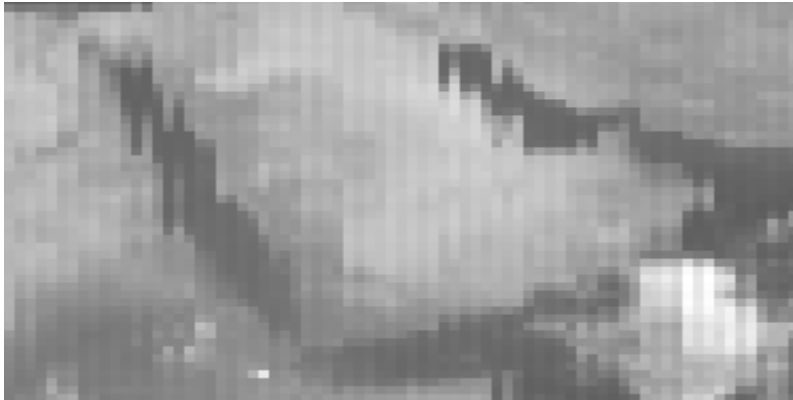


After reordering columns

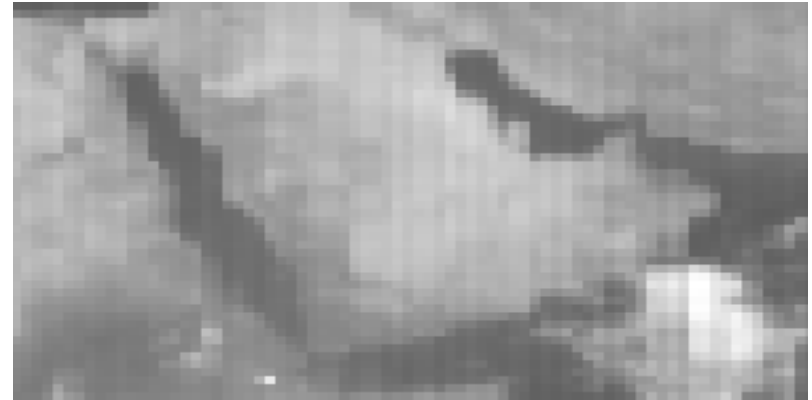


After interpolation and merging

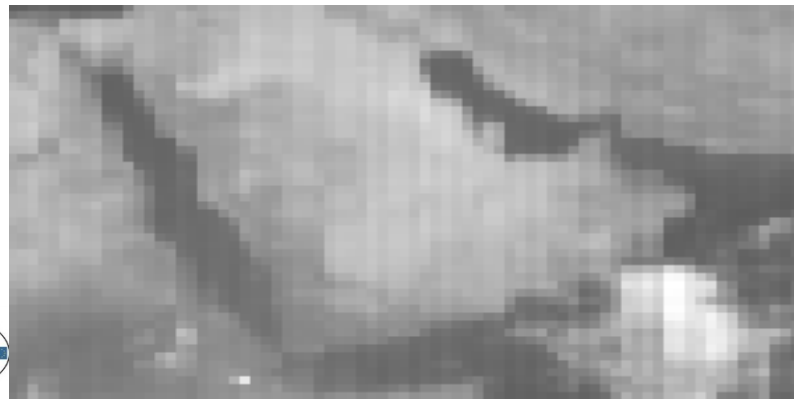
## Correcting 282 column TW TSOL jitter



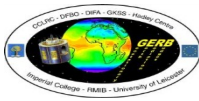
Input image



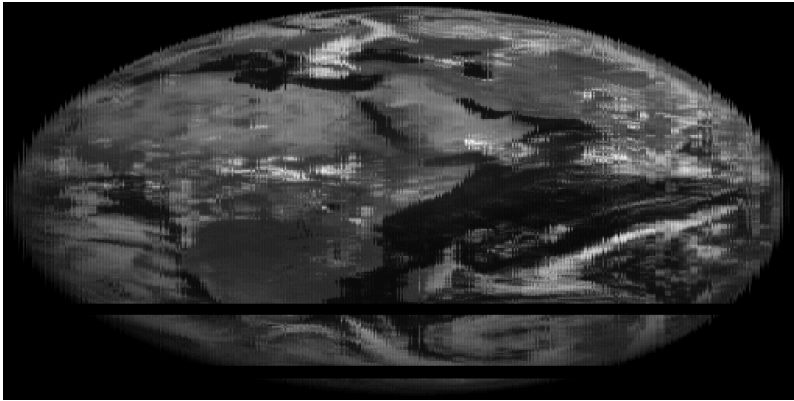
After reordering columns



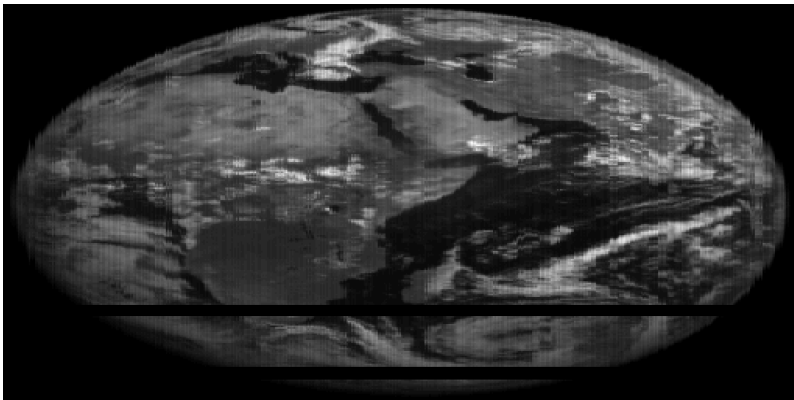
After interpolation and merging



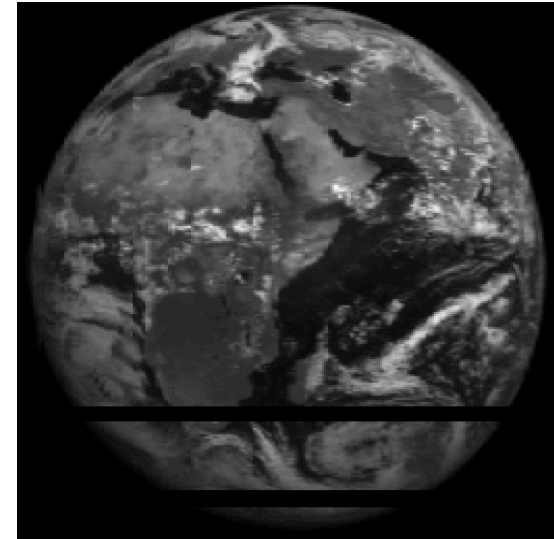
## Correcting 564 column SW TSOL jitter



Input image

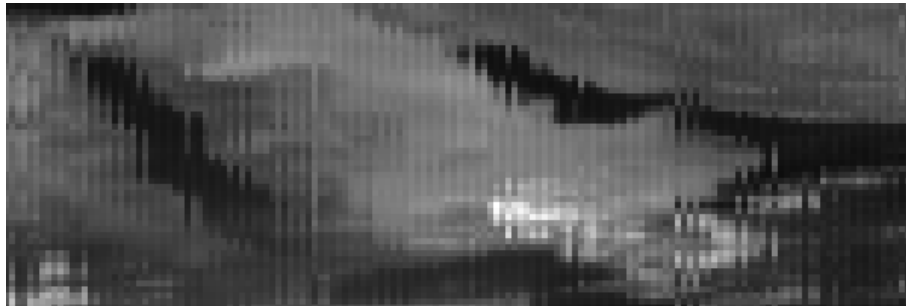


After reordering columns

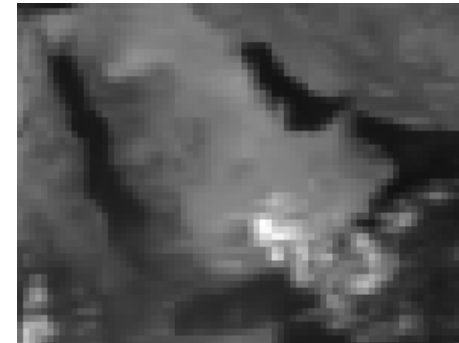


After dropping back mirror columns  
and interpolation

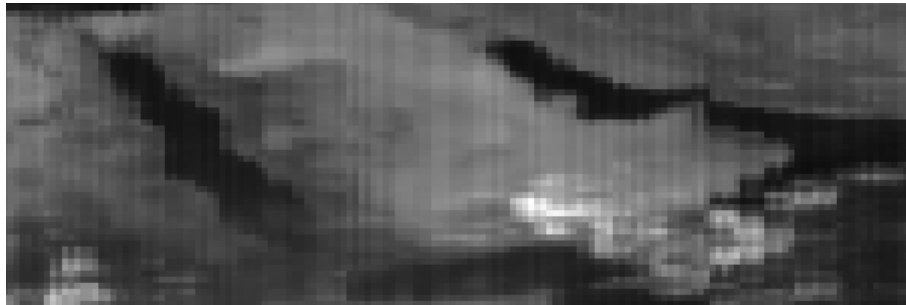
## Correcting 564 column SW TSOL jitter



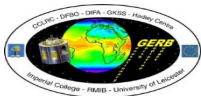
Input image



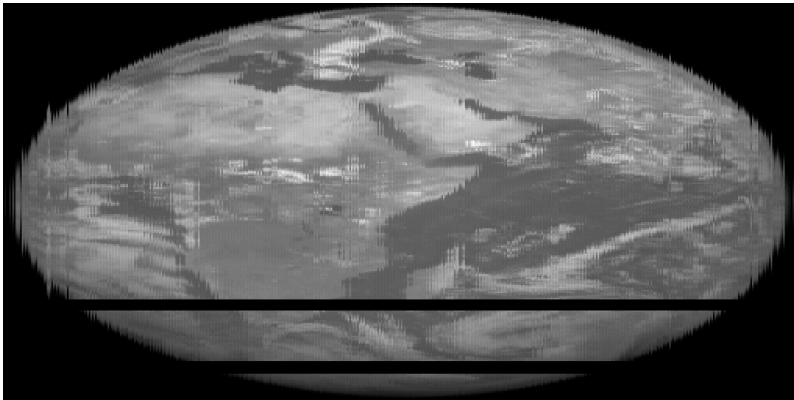
After dropping back mirror columns  
and interpolation



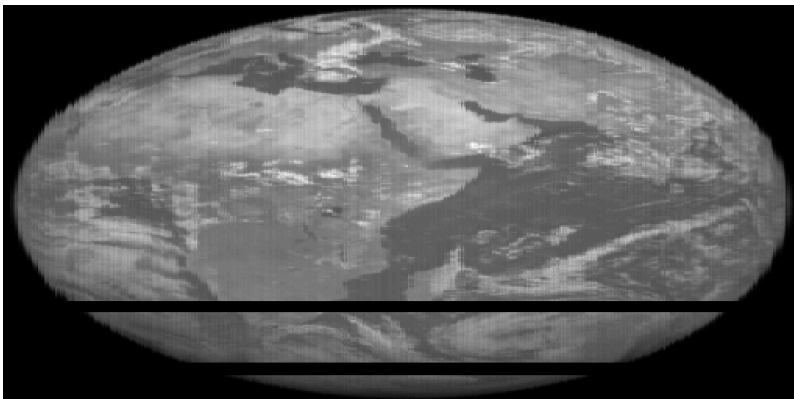
After reordering columns



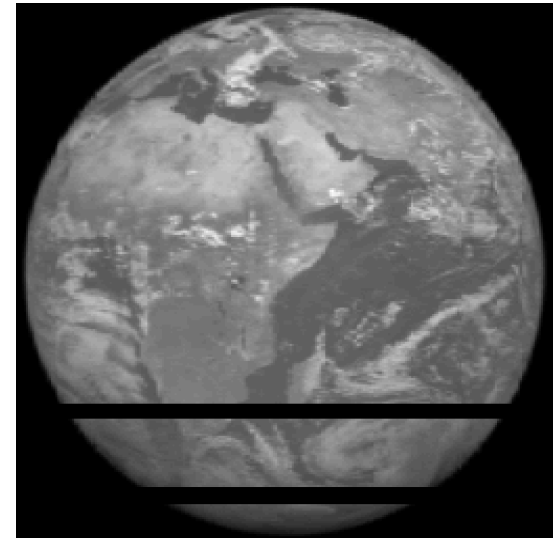
## Correcting 564 column TW TSOL jitter



Input image



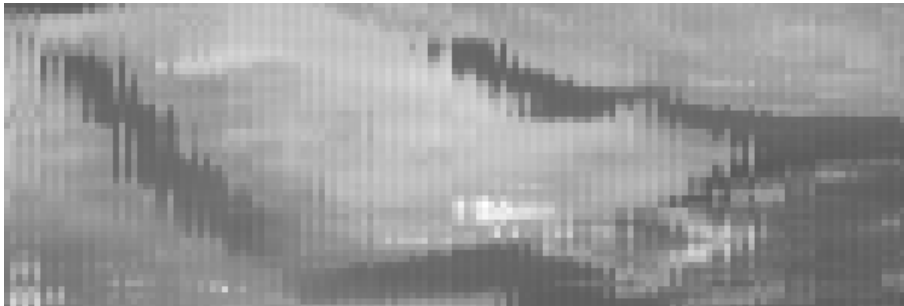
After reordering columns



After dropping back mirror columns  
and interpolation



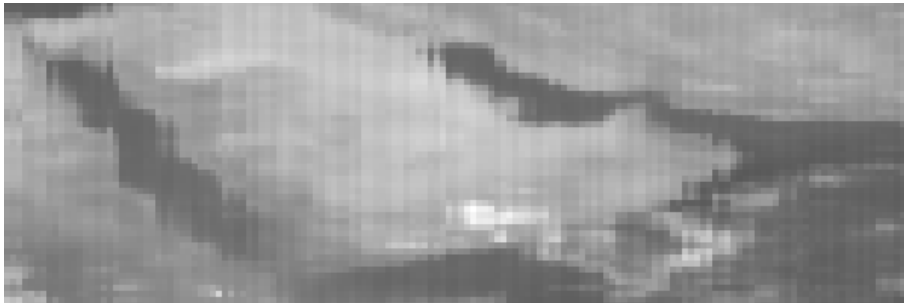
## Correcting 564 column SW TSOL jitter



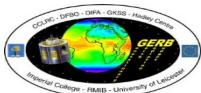
Input image



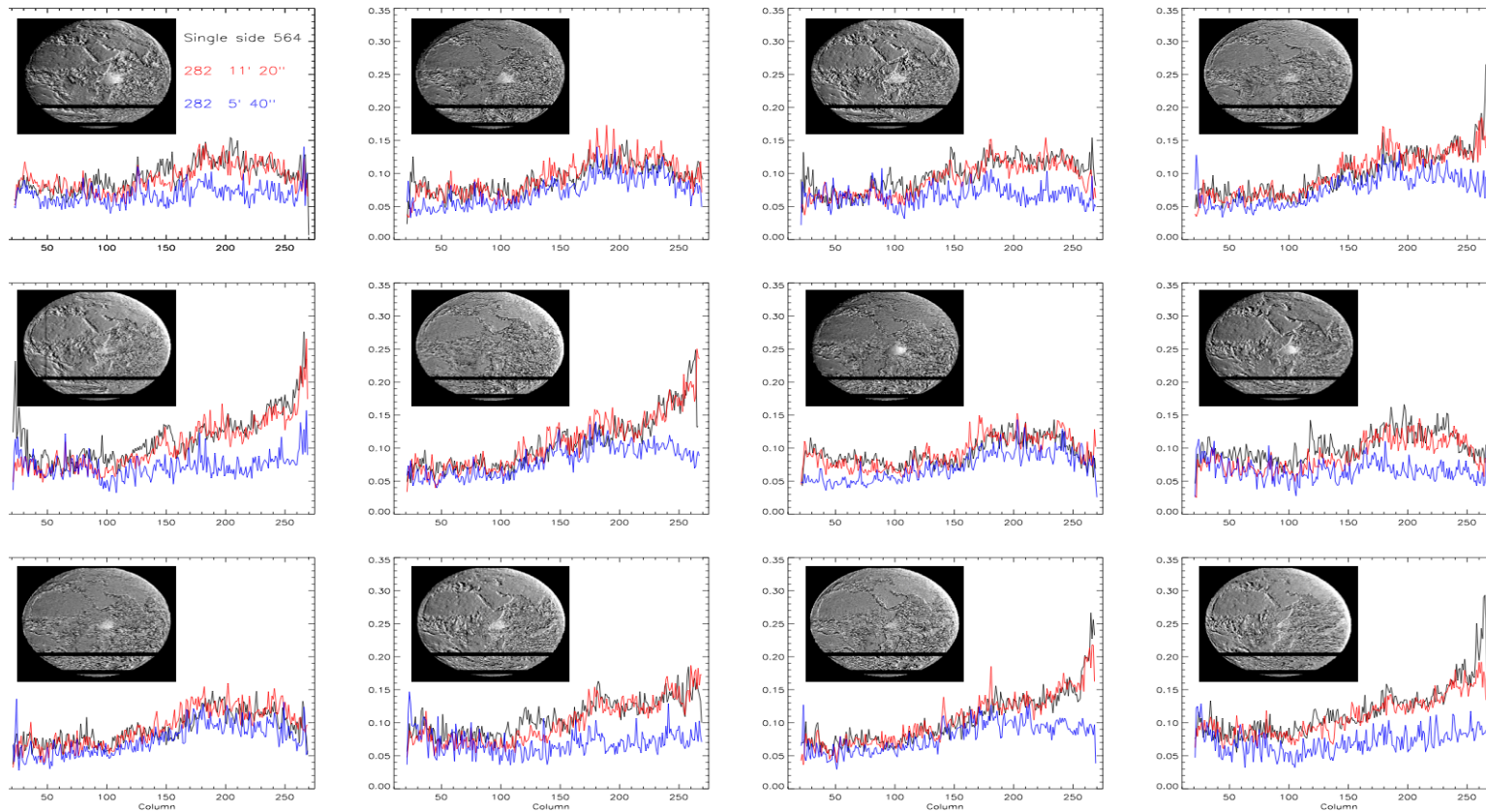
After dropping back mirror columns  
and interpolation



After reordering columns

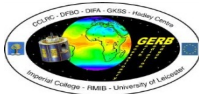


# Effect of reduction of temporal resolution (J. Rufus)



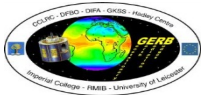
# GERB future plans

- GERB-4
  - Correct pixel misalignment
  - Investigate brightness problem
- GERB-3
  - Data is reprocessed with mirror face correction
  - Needs to be validated
- GERB-2
  - Future data taking using 564 columns when operating with ESU
  - Adapt RGP processing for coping with increased image acquisition time
  - Apply mirror face correction on 282 column recordings
  - Validate the output



# Summary

- GERB-2
  - Image quality suffers from several technical problems. We get these slowly under control.
  - Still work to be done on RGP to get the GERB products
  - Validation needed before release can be done
- GERB-3
  - Image quality problems under control
  - Validation needed before release
- GERB-4
  - Minor(?) problems still to be solved
- RGP release 2
  - On hold (manpower lacking)



Thank you for your attention!

Questions?

